

1501

**OPTICAL
CARD
SCANNER**



MRC
MEASUREMENT
RESEARCH
CENTER

OPTICAL CARD SCANNING

is a technique whereby information can be read from a document by electronic photosensitive devices and translated into a form readily usable by computers.

The MRC 1501 Card Scanner reads position-coded information from tab card size documents, and feeds the information into a computer and onto magnetic tape directly from the source document. It reads pencil marks, imprinted codes, printed marks, and punched holes simultaneously from a single card, and translates the information into appropriate form for "on-line" input to the associated computer.

The recording of source information on the cards is easily done by simply filling in ovals or circles with

an ordinary soft lead pencil. "Turn around" card documents can be readily identified by preprinting or pre-punching in advance of their distribution. Only new information need be entered on the cards in the field, with no wasteful repetitious recording and reprocessing of relatively static data.

Using the 1501, manual key punching of cards can be completely eliminated, with consequent sharp reductions in processing time and cost.

The MRC 1501 Optical Scanner speeds up information input to more nearly match the high speeds of electronic computers. It thereby overcomes a common cause of "bottlenecks" in computerized data processing systems.



ELIMINATE

the

bottleneck

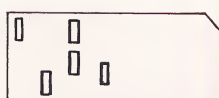
of

costly,

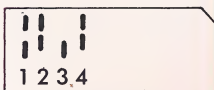
error prone,

time consuming

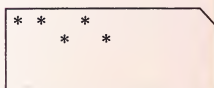
key punching.



PUNCHED



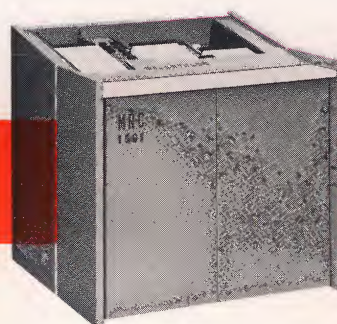
IMPRINTED



PREPRINTED



PENCIL MARKED



COMPUTER

By drastically reducing and simplifying paperwork, the MRC 1501 introduces a new era in data processing. **IN ONE HOUR** the MRC 1501 can read the volume of data equal to the output of 1440 KEY PUNCH MACHINES.

1501 OPERATING CHARACTERISTICS

The MRC Optical Card Scanner is the result of many years of experience in the design and manufacture of optical scanning machines. The use of this equipment has been in large-scale, nationwide educational data processing operations.

The 1501 card reader is an electronic-mechanical device which automatically (under computer control) feeds tabulating cards at rates up to 90,000 cards per hour. It reads position-coded, pencil marked, printed, and imprinted information from both sides of the card in a single pass while simultaneously reading punched hole information. This information is, at the same time, translated into appropriate form for "on-line" input to a computer.

DOCUMENT CAPACITY

The 1501 uses a standard tabulating card size document with the customary 80 columns across the card. Each column can contain up to 30 marking positions or twelve punched hole positions. The theoretical maximum capacity of the card is 4800 marking positions read from both sides of the card by MRC's newly developed reflected light reading heads.

SPEED

The 1501 has a maximum speed of 1500 cards per minute. The 1501 is "slaved" to the associated computer and feeds a card document only when requested to do so by the computer. Throughput rate is consequently controlled by the associated computer and its program.

ACCURACY

The extremely high accuracy of mark reading is due to the 1501's unique discrimination capability (the ability to select the darkest mark from a group of marking positions) which automatically selects intended marks and ignores erasures and smudges. The 1501's discrimination circuitry and its unique reading head provide extremely accurate reading even of marks made in relatively uncontrolled situations.

Numerous error detection circuits and program checks are built into the 1501 system to detect and iden-

tify potential machine errors or mistakes and omissions made in marking the document.

RELIABILITY

Over 20,000,000 cards from the field have been processed with a prototype of the 1501, and several hundred million sheets have been processed by MRC's optical sheet scanners using similar principles of discrimination mark sensing. Downtime has been minimal and error rates exceedingly low.

Reliability is ensured by the conservative solid state design incorporating a large number of integrated circuits, by extensive in-use testing, and by rigid control of craftsmanship during manufacturing and testing.

INTERFACE REQUIREMENTS

Interfaces to two widely used computer series are available for the 1501, and are at present considered standard. Interfaces to other computers are available on special order.

OPTIONS

To increase the scanner's versatility and to meet special needs of 1501 users, certain options are offered:

- a. Addressograph-Multigraph bar code reading head which enables the 1501 to read the imprinted A-M bar code from cards simultaneously with position-coded pencil marks, printed marks, and punched holes.
- b. Additional discrimination and encoding circuitry provide for accurate reading of pencil marked program statements in the Fortran and PLI language sets.
- c. Output stacker selection permits physical sorting of documents in accordance with user criteria.
- d. Ten columns per inch spacing, which matches computer printer character spacing, for use with turn-around documents.

PHYSICAL CHARACTERISTICS

Size — 40" high x 39" long x 33" deep.
Weight — 500 pounds
Heat Dissipation — 4000 BTU/hour
Power — 3-wire, 230 VAC \pm 10%, single phase, 1.5 KVA
Environment — 60°-80° F, 35%-60% relative humidity.

SUPPORT CAPABILITIES

MRC intends that the described support services will be made readily available to all 1501 users. MRC is also devoting a major share of its energy and resources to the continual extension and improvement of these services.

SOFTWARE

Software for communication between the 1501 and the associated computer system, generalized editing programs, and formatting routines will be furnished for either of two widely used computer systems. Similar software for other computer systems is available on special order.

MRC offers its services as a software clearing house for 1501 users with reference to educational applications, particularly in the area of educational information systems. For example, the CardPac data collection system, course scheduling programs, and pupil accounting systems developed by the Iowa Educational Information Center are available.

SYSTEMS CONSULTING AND CONTRACT PROGRAMMING

Since its entry into the field of automated educational data processing in 1953, MRC has necessarily been deeply involved in continuously expanding efforts in systems study, analysis, and synthesis. MRC has a large staff of permanent, full-time, professional systems analysts and programmers, who are thoroughly familiar with the capabilities of MRC Optical Card Scanning Systems. They have many years of experience in the specialized and sophisticated use of computers and optical scanning equipment in the field of educational data processing. This wealth of knowledge and experience enables MRC to provide its customers with the best in programming assistance and systems consulting for the use of the 1501 with their computers.

DOCUMENT DESIGN

Adherence to MRC specifications regarding printing tolerances is mandatory if the maximum accuracy, flexibility, reliability, and efficiency inherent in the 1501 Optical Card Scanner system are to be achieved.

MRC's document design specialists have a broad appreciation of the needs and requirements of users of documents in varied fields, as well as a thorough understanding of the MRC optical scanner systems and of data processing in general. With this combination of background knowledge and technical skills, the MRC staff is unusually well qualified to give expert assistance in the design of new forms and the adaptation of existing documents.

ENGINEERING

Regular maintenance on MRC 1501 Optical Card Scanners can be performed by the resident customer engineer who is responsible for maintaining the associated computer equipment. He will be trained by MRC and will be supplied with the necessary maintenance manuals, circuit diagrams, parts catalogs, and a stock of spare parts. MRC's highly skilled crews will provide emergency back-up maintenance. MRC will maintain an adequate supply of all necessary spare units.

MRC's R & D laboratories, manufacturing facilities, test and inspection groups, and installation and maintenance crews are staffed with top level electronic and mechanical engineers, designers, technicians, and other specialists with extensive experience in optical scanning and data processing equipment. This complete engineering organization enables MRC to provide its customers with sophisticated, trouble free hardware, and the best in installation and high level maintenance capabilities. MRC is also willing and able to use its engineering facilities to develop and manufacture specialized hardware for unique systems requirements.

PROCESSING SERVICE

For many years MRC has provided a nationwide educational data processing service. This service organization continues to expand rapidly in size, range of services available, new and unique equipment utilized, and in efficiency as measured by accuracy, price, and turn-around time. This experienced organization can provide customers with facilities for tryout of new programs and with processing assistance during unusual peak overload periods. The MRC data processing service agency will, of course, provide complete data processing services for those organizations not, at present, contemplating acquisition of their own equipment.



MRC

MEASUREMENT RESEARCH CENTER, INC.,

established in 1953, is a professional, university-based organization. MRC is an off-spring of the pioneer Iowa Testing Programs. Its fundamental purposes are to facilitate the improvement of education and to conserve human resources. MRC does this by developing automated devices and systems for gathering and analyzing large quantities of information originating from a multitude of sources, and providing such devices, systems, and data processing services to schools, educational agencies, and other organizations at a reasonable cost.

As a not-for-profit corporation, MRC uses all excess income (over operating expenses and reserve requirements) for educational research at the University of Iowa.

Well over a decade ago, under the direction of E. F. Lindquist, MRC developed the first practical electro-mechanical machine and associated system for the mass scoring of millions of objective tests for schools throughout the nation.

Maintaining its early position of leadership, MRC has grown rapidly into a large and versatile center for providing data processing services. MRC has been successful because of its unique combination of optical scanning machines and other data processing devices, strong engineering research and development programs, extensive systems support, and document design and printing services.

For many years MRC has provided test scoring and data processing services for several major publishers: Harcourt, Brace, and World; Houghton Mifflin Co.; Science Research Associates; and Psychological Corporation. MRC is also the data processing agency for the American College Testing Programs (ACT), the Iowa Education Information Center, and various governmental agencies.

FORTRAN CARD

Each FORTRAN instruction or comment is pencil marked rather than key punched into the card. This is particularly convenient and useful in courses of instruction in programming because:

- An ordinary eraser-tipped soft lead pencil is the only device needed for preparing program decks, for recording data, and for correcting mistakes.
- Programming exercises can be completed in the classroom or can be done elsewhere, according to circumstances.

(over)

COMMENT STATEMENT NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
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20002	0	1	2	3	4	5	6	7	8	9	+	-	*	/	=	blank	blank
30003	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
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60006	0	1	2	3	4	5	6	7	8	9	+	-	*	/	=	blank	blank
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90009	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q

- Elimination of the need for key punching voids a major source of delay and error and consequent waste of instructional time.
- Access to key punch facilities need not be a factor in the location of classrooms.
- Marked FORTRAN instruction cards and data cards may be intermixed with punched cards for simultaneous reading in the 1501.

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**UNIVERSITY
FORTRAN
DOCUMENT**

PAYROLL TIME CARD

- Can be prepunched with the employee's payroll number, name, work area, and other necessary data.
- Can carry any desired variable data entered by the employee or a payroll clerk with a common lead pencil.
- Provides positive employee and job identification with direct access to computer processing of the payroll.
- Provides the necessary data for job cost analysis.

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		80	80	8	8	8	8	8	8	8	8
		90	90	9	9	9	9	9	9	9	9
		MONTH DAY		DISTRIBUTION CODE				HOURS			

START AT TOP

IN	07.0
OUT	12.0
IN	13.0
OUT	18.2



- Provides accurate, reliable patient identification of clinical laboratory tests.
- Allows direct access to a computer for fast turn-around of information and prompt preparation of physicians' reports.
- Provides, as a by-product, direct entry of laboratory charges for patient billing.
- With the 1501 system, makes test results and historical data immediately available for medical research purposes.

29946

S-PB				U-PB				S-FE++TOT.				S-FE++B.C., %				U-17-OH STER.							
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- Is used as a source document, thereby eliminating the usual coding and key-punching steps.
- Has a large data recording capacity—130 digits.
- Complements the Fortran programming card by providing a method of developing input data for Fortran programs.
- Can use prepunched identifying information which will be read simultaneously with the marked data.

P. O. BOX 30 • IOWA CITY • IOWA 52240

[illegible]

DO NOT WRITE IN THIS SPACE

MRC UNIVERSAL CARD

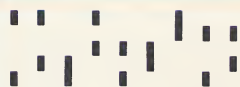
14854



EDUCATIONAL SYSTEMS DIVISION
MEASUREMENT RESEARCH CENTER

STUDENT BILLING CARD

- An optional reading device on the MRC 1501 Card Scanner provides for the reading of imprinted bar code marks.
- Source data collection is handled with ease.
- Records enter the student accounting system at computer speeds, by-passing key punching.



123456789

JOHN L JONES
ANAMOSA IOWA

STUDENT NAME

STUDENT I. D. NUMBER

STATE
UNIVERSITY

STUDENT
CHARGE
CARD



1234567

AMOUNT
OF THIS
CHARGE


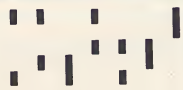
ACCOUNT
NUMBER

MRC

P. O. BOX 30 • IOWA CITY • IOWA 52240

GENERAL STORES INVENTORY CARD

- Permits positive identification of inventory items through use of imprinted stock numbers.
- Allows fast access to accounting systems for cost purposes.
- Provides an accurate, up-to-date means of inventory control, reducing costly "on order" delays and shortages.

 <p>1234567890</p> <p>DESK, OFFICE</p>	<p>TYPE TRANSACTION</p> <p><input checked="" type="radio"/> Receipt</p> <p><input type="radio"/> Disbursement</p> <p><input type="radio"/> On Order</p> <p><input type="radio"/> Return — Supp.</p> <p><input type="radio"/> Return — Stk.</p> <p><input type="radio"/> Non-Inventory</p> <p><input type="radio"/> In-Process</p>	<p>DATE</p> <table border="0"> <tr> <td><input type="radio"/> Jan.</td> <td><input type="radio"/> 00</td> <td><input type="radio"/> 1965</td> </tr> <tr> <td><input type="radio"/> Feb.</td> <td><input checked="" type="radio"/> 10</td> <td><input checked="" type="radio"/> 1966</td> </tr> <tr> <td><input type="radio"/> Mar.</td> <td><input type="radio"/> 20</td> <td><input type="radio"/> 1967</td> </tr> <tr> <td><input type="radio"/> Apr.</td> <td><input type="radio"/> 30</td> <td><input type="radio"/> 1968</td> </tr> <tr> <td><input type="radio"/> May</td> <td><input type="radio"/> 40</td> <td><input type="radio"/> 1969</td> </tr> <tr> <td><input type="radio"/> Jun.</td> <td><input type="radio"/> 50</td> <td><input type="radio"/> 1970</td> </tr> <tr> <td><input type="radio"/> Jul.</td> <td><input type="radio"/> 60</td> <td></td> </tr> <tr> <td><input type="radio"/> Aug.</td> <td><input type="radio"/> 70</td> <td></td> </tr> <tr> <td><input type="radio"/> Sep.</td> <td><input type="radio"/> 80</td> <td></td> </tr> <tr> <td><input checked="" type="radio"/> Oct.</td> <td><input type="radio"/> 90</td> <td></td> </tr> <tr> <td><input type="radio"/> Nov.</td> <td></td> <td></td> </tr> <tr> <td><input type="radio"/> Dec.</td> <td></td> <td></td> </tr> </table> <p>MONTH DAY YEAR</p>	<input type="radio"/> Jan.	<input type="radio"/> 00	<input type="radio"/> 1965	<input type="radio"/> Feb.	<input checked="" type="radio"/> 10	<input checked="" type="radio"/> 1966	<input type="radio"/> Mar.	<input type="radio"/> 20	<input type="radio"/> 1967	<input type="radio"/> Apr.	<input type="radio"/> 30	<input type="radio"/> 1968	<input type="radio"/> May	<input type="radio"/> 40	<input type="radio"/> 1969	<input type="radio"/> Jun.	<input type="radio"/> 50	<input type="radio"/> 1970	<input type="radio"/> Jul.	<input type="radio"/> 60		<input type="radio"/> Aug.	<input type="radio"/> 70		<input type="radio"/> Sep.	<input type="radio"/> 80		<input checked="" type="radio"/> Oct.	<input type="radio"/> 90		<input type="radio"/> Nov.			<input type="radio"/> Dec.			<table border="0"> <tr> <td>0</td><td>0</td><td>●</td><td>0</td> </tr> <tr> <td>1</td><td>1</td><td>1</td><td>1</td> </tr> <tr> <td>2</td><td>2</td><td>2</td><td>2</td> </tr> <tr> <td>3</td><td>3</td><td>3</td><td>●</td> </tr> <tr> <td>4</td><td>4</td><td>4</td><td>4</td> </tr> <tr> <td>5</td><td>5</td><td>5</td><td>5</td> </tr> <tr> <td>6</td><td>6</td><td>6</td><td>6</td> </tr> <tr> <td>7</td><td>●</td><td>7</td><td>7</td> </tr> <tr> <td>8</td><td>8</td><td>8</td><td>8</td> </tr> <tr> <td>●</td><td>9</td><td>9</td><td>9</td> </tr> </table> <p>REQUISITION NUMBER (IF APPLIES)</p>	0	0	●	0	1	1	1	1	2	2	2	2	3	3	3	●	4	4	4	4	5	5	5	5	6	6	6	6	7	●	7	7	8	8	8	8	●	9	9	9	 <p>1234567</p> <table border="0"> <tr> <td>QUANTITY</td> <td>ACCOUNT NUMBER</td> </tr> </table>	QUANTITY	ACCOUNT NUMBER
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STATE UNIVERSITY

GENERAL
STORES INVENTORY

STUDENT REGISTRATION CARD

The MRC 1501 Card Scanner can greatly accelerate the task of registering students for courses. The ability of the 1501 to read pencil marks, punched holes, preprinting, and bar code imprinting permits several ways of employing scannable registration cards. For example, one may:

- Have the student mark his ID number and course requests in pencil on the registration card.
- Imprint the student ID number on the card from his embossed plastic bar-coded ID card, and have him mark his course requests in pencil.

(over)

STUDENT I D		CLASS		STUDENT NAME																					
1 2 3 4 5 6 7 8 9		10		JONES, JOHN L.																					
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7 7 7 7 0		7 7 7 7 7		7 7 7 7 7																				COURSE NAME	
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9 9 9 9 9		9 9 9 9 9		9 9 9 9 9																				COURSE 2	
																								COURSE 3	
																								COURSE 4	
																								COURSE 5	

EXAM SERVICE CARD

- Has the same capacity as an 8½" x 11" sheet – 150 items.
- Is a convenient size for classroom testing situations.
- Provides marking areas for name, ID number, course number, etc. Directly from these cards a computerized exam service can provide a wide range of report sequences – section lists, alphabetic lists, rank order lists, etc.

(over)

UNIVERSITY EXAM SERVICE

COURSE	SECTION	SEX	YOUR NAME LAST NAME FIRST	
6	3	2	0	7
2	1	1	3	J
0	2	1	3	O
7	2	1	3	N
2	1	1	3	S
1	1	1	3	J
3	1	1	3	O
J	1	1	3	N
O	1	1	3	N
N	1	1	3	N
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J	1	1	3	

MARK ONLY IN THE OVALS—
MAKE NO STRAY MARKS

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73	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
74	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

80961

YOU MUST USE A NO. 2 PENCIL

With the 1501, allows quick turn-around time and fast production of finished reports.

Facilitates making an item analysis as a by-product of the test scoring, since response data are sent directly to the computer.

MRC 1501 OPTICAL CARD SCANNER



EXAM SERVICE

GRADE REPORTING

REGISTRATION

RESEARCH SURVEYS

CLINICAL RECORDS

STUDENT CHARGES

QUESTIONNAIRES

HOSPITAL BILLING

LIBRARY TRANSACTIONS

COURSE SCHEDULING

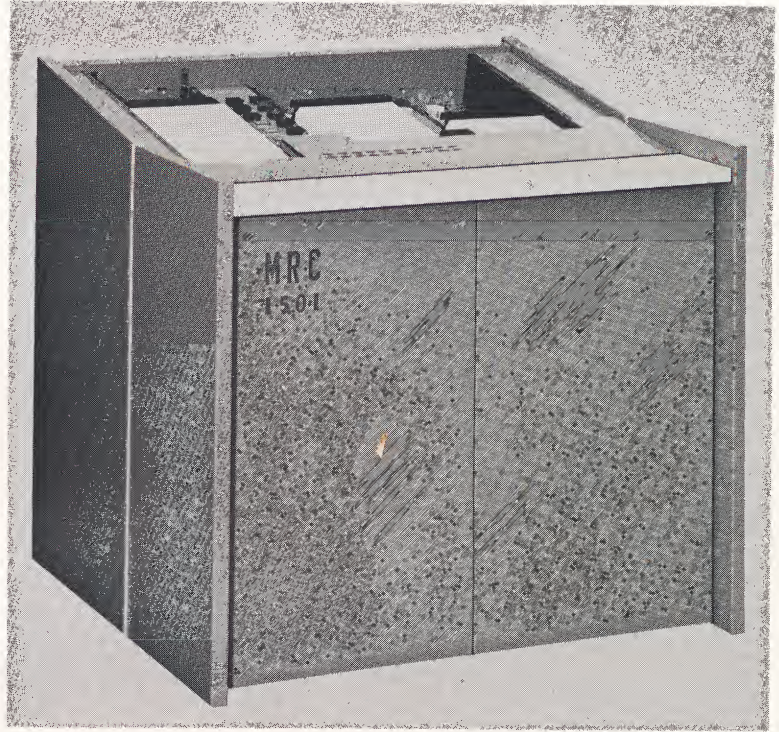
FORTRAN CLASSES

INVENTORY CONTROL

Because of the 1501's unique ability to read punched holes, preprinted information, A-M bar codes, as well as pencil marks from both sides of the card in a single pass through the machine, it serves admirably for processing "turn-around" documents. In these cases, information already contained in the central computer files, such as name, address, ID number, inventory stock number, etc. may be prepunched and preprinted (by the computer); the individual in the field, using only a common soft lead pencil, need only supply current updating information. The wasteful repeated filling out of forms with the same information — name, serial number, etc. — is eliminated. Only new information need be recorded on the document.

THE MRC 1501 MARK SCANNER

- Designed specifically for use in Educational Data Processing Installations
- Scans marks and reads punched holes simultaneously at a rate of 1500 cards per minute
- 4800 marking positions per card — 30 positions per column, 80 columns front and back
- Latest optical sensing techniques based upon MRC's experience of optically scanning millions of documents
- Discrimination scanning — Selecting the darkest mark out of a field, thereby eliminating problems due to smudges and erasures
- Interfaces directly to your computer system — Interface presently available for the IBM 360 and Honeywell 200 family
- Maintenance arranged with computer manufacturer
- Many scanner options are available — For example, Addressograph bar code reading. This feature allows the 1501 to read the imprinting from plastic I.D. cards



- Typical application areas — Grade reporting — Teacher tests — Student billing — Hospital billing — Hospital clinical records — Programming courses — Questionnaires and surveys — Data bank development
- Turn around Processing via pre-punching, pre-printing (computer printed marks), and imprinting
- Typical lease price — \$1500/month — 3 year contract available

EDUCATIONAL SYSTEMS DIVISION
MEASUREMENT RESEARCH CENTER
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IOWA CITY, IOWA 52240

